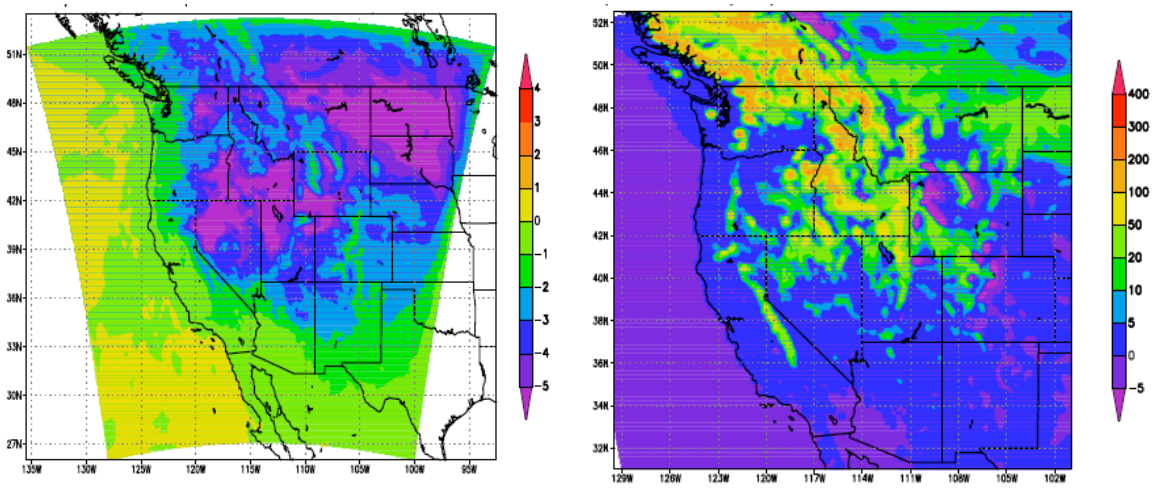

Figure 1. Difference in surface temperature (left) and snow water equivalent (right) for December-January-February of a cold season from two WRF-NOAH simulations with snow emissivity values of 1.0 and 0.9 respectively.

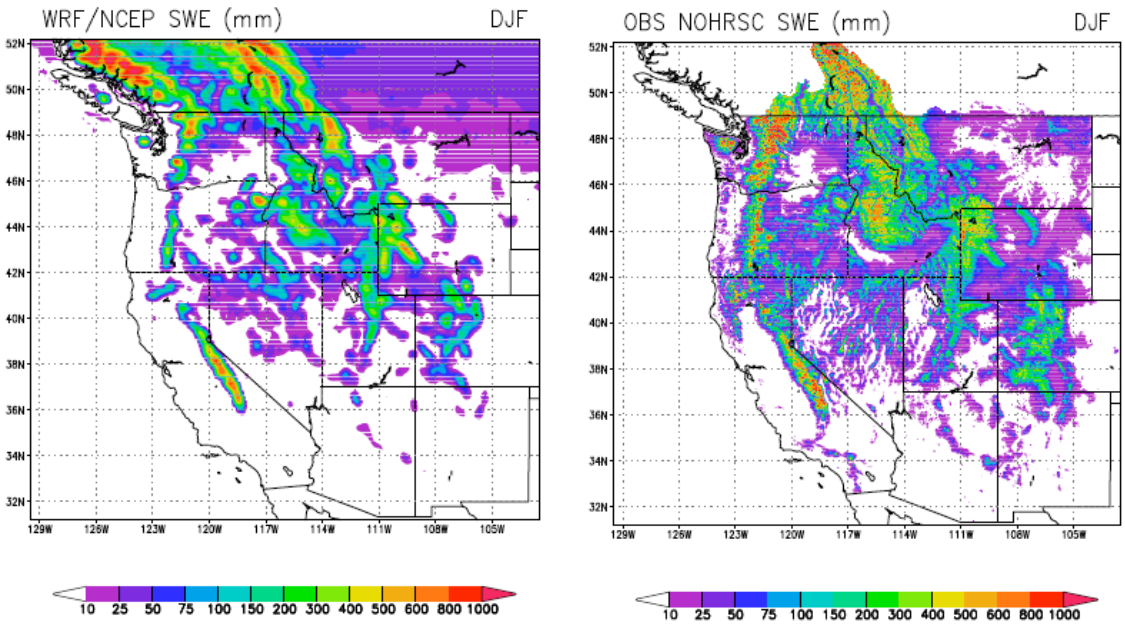

Figure 2. Observed (right) and simulated (left) December-January-February (DJF) mean snow water equivalent (SWE) based on a 10-year simulation with the WRF-NOAH model at 15 km spatial resolution driven by the NCEP/DOE global reanalysis. Observations are based on the NOHRSC snow product.

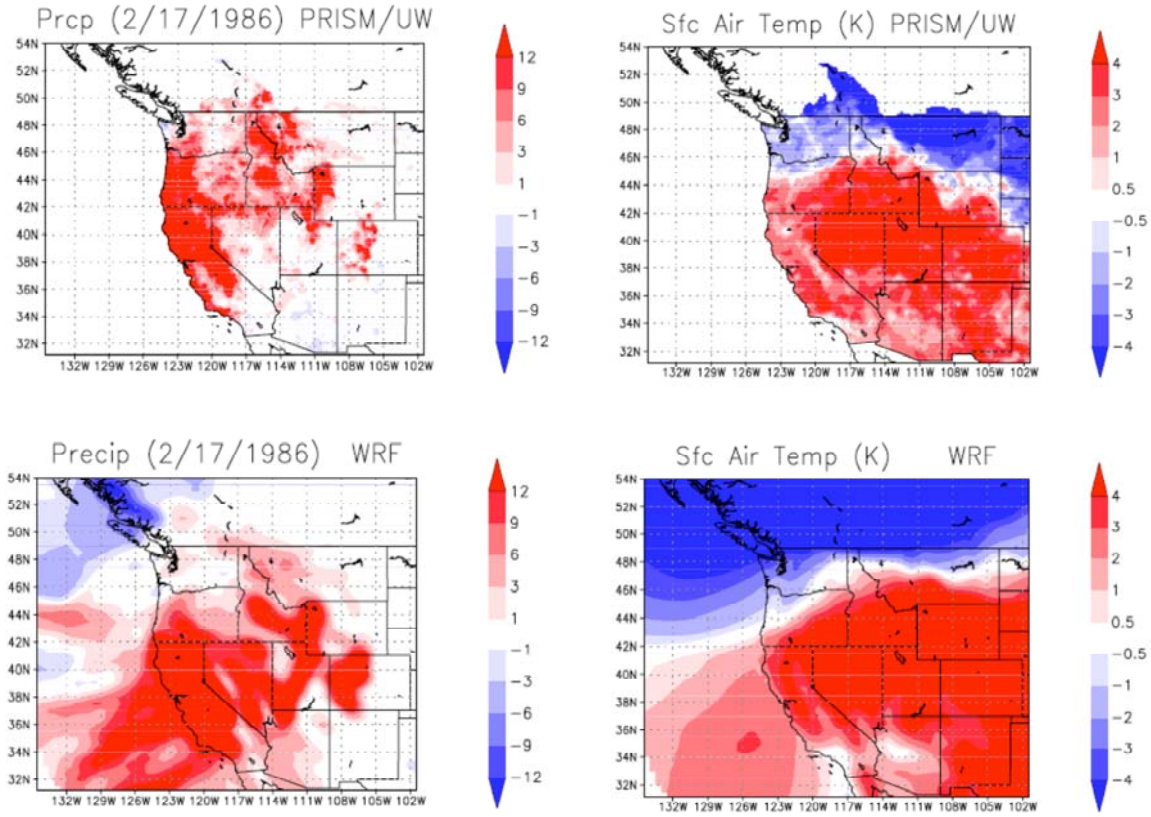

Figure 3. Observed (top) and simulated (bottom) precipitation (left) and surface temperature (right) anomalies of the 1986 President Day “Pineapple Express” event, showing heavy precipitation and warmer than normal over California.

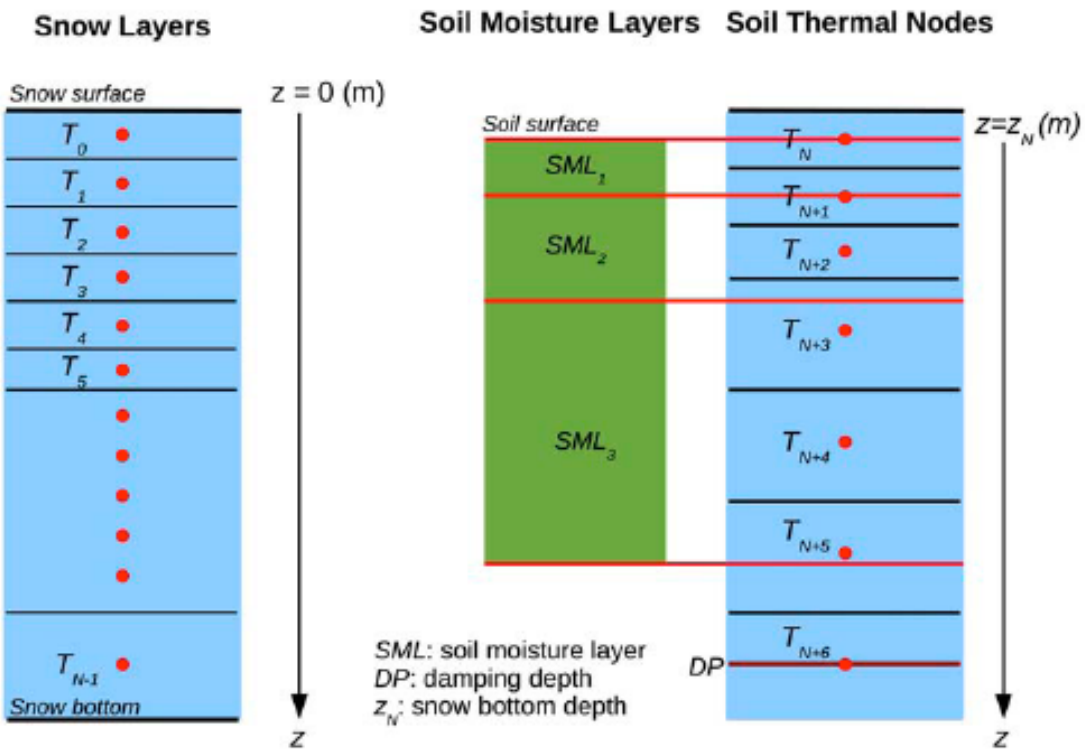

Figure 4. Soil-snow system layer structure. For illustration purposes, the number of the soil layers is assumed to be seven.

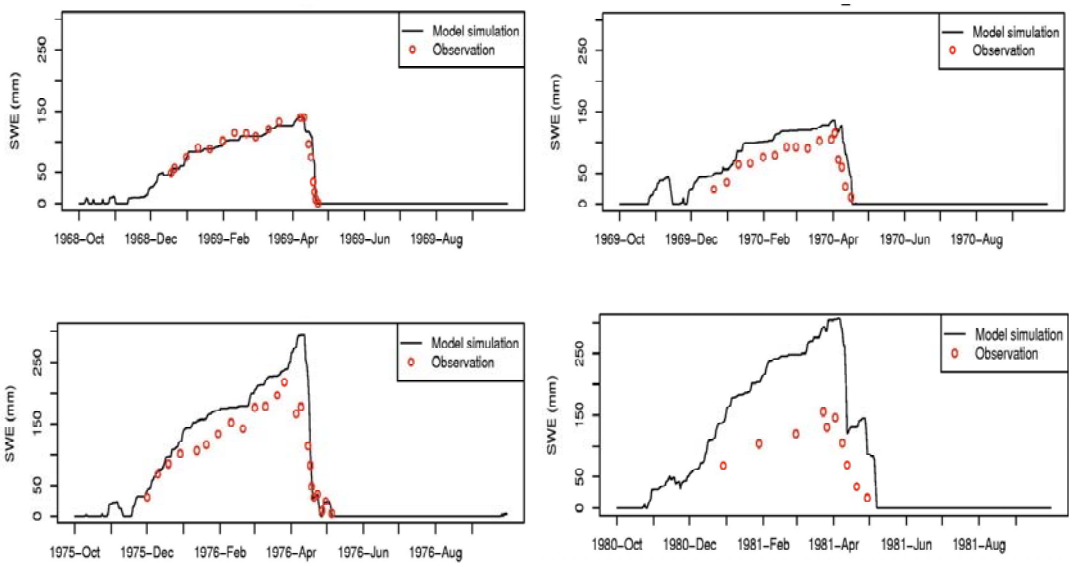

Figure 5. Simulation results of SWE at the Valdai station, Russia.

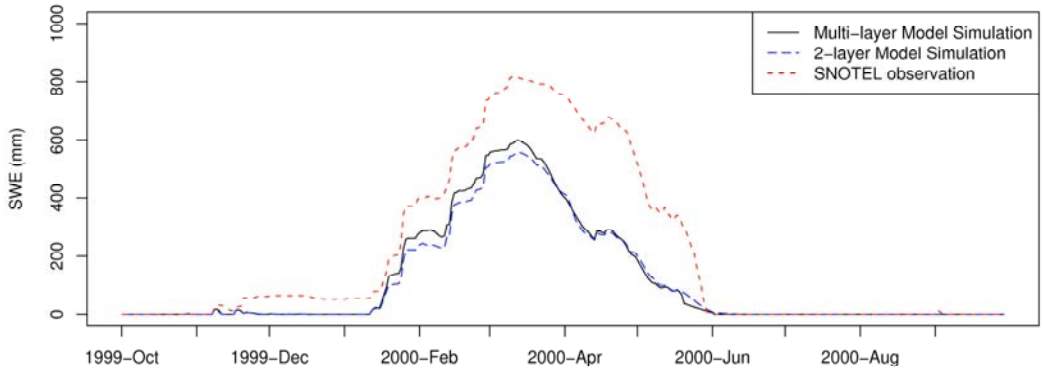

Figure 6. Comparison of SWE simulations between the multi-layer model and 2-layer model.

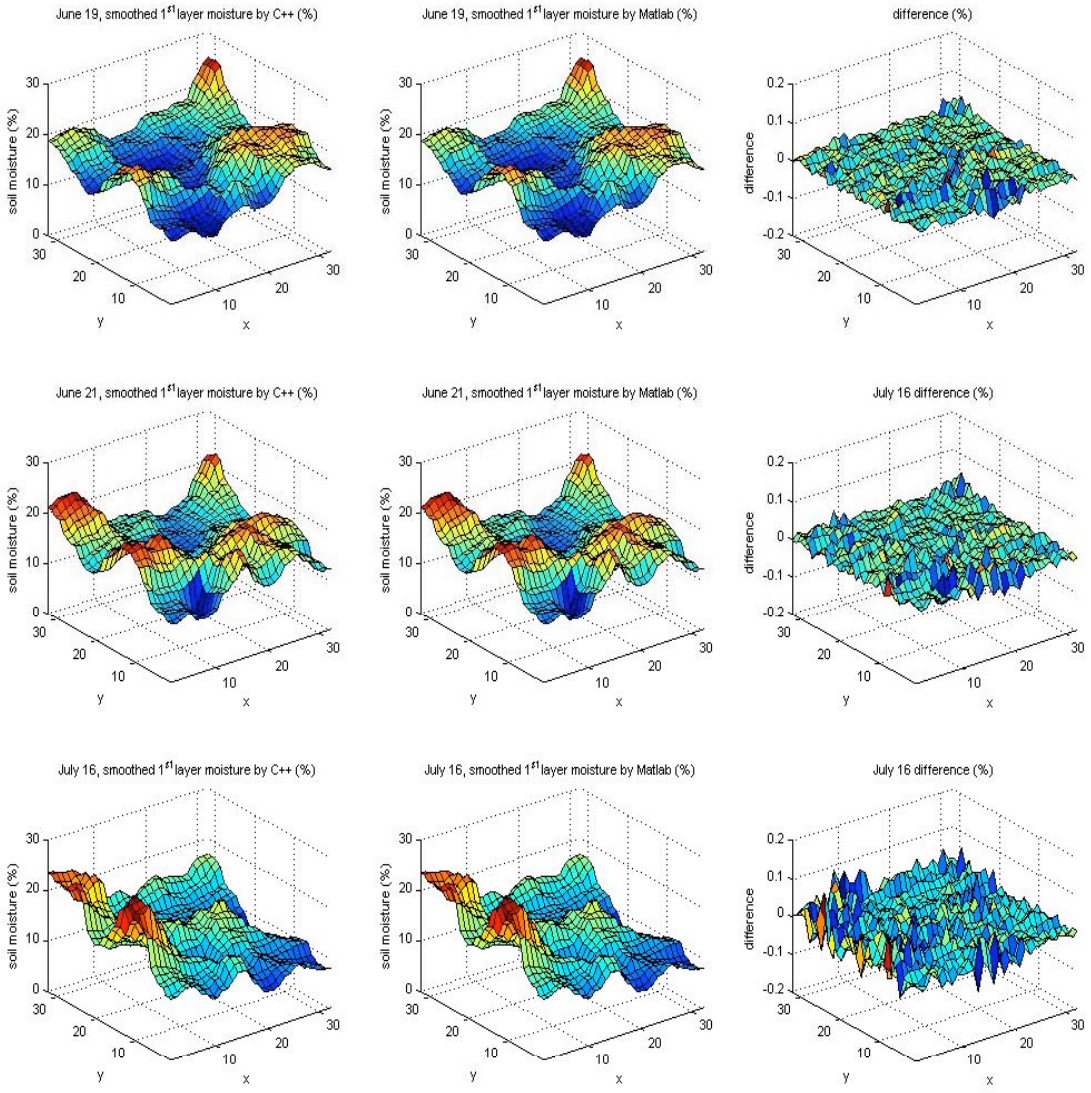

Figure 7. Comparison of soil moisture spatial distribution in the 1st soil layer between the new C++ spatial data assimilation framework (1st column) and the matlab version (2nd column) for three different days. The 3rd column shows the differences in percent between the C++ and matlab version.

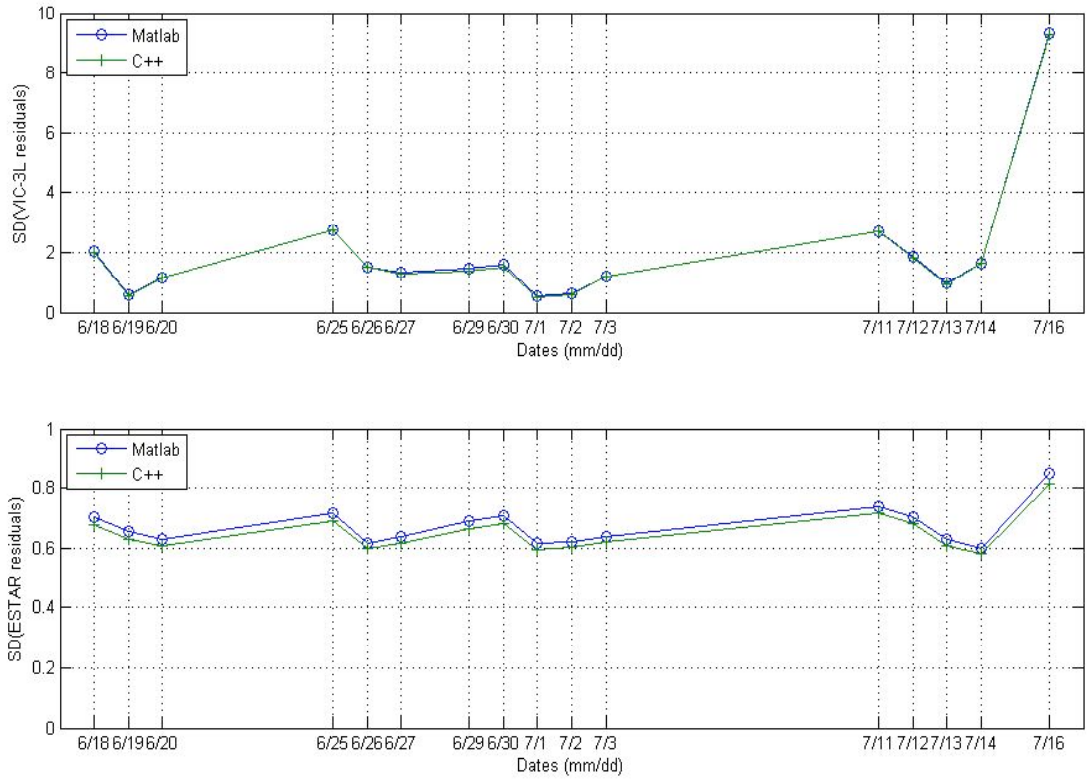

Figure 8. Comparisons of the two codes (i.e., C++ vs. matlab) for the standard deviations of VIC-3L and ESTAR assimilation residuals for the SGP97 experimental period. The vertical dotted lines represent the dates in which data assimilations have been conducted.